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This report examines the appropriateness of utilizing Fixed-Price contracts for Army GOCO Ammunition Plant Production. The major focus is on the relative stability of the ammunition production requirements and if that stability reasonably permits the proper use of fixed-price contracts.

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APPLICABLE CONTRACT TYPES FOR GOCO AMMUNITION PLANT PRODUCTION

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MARCH 1987

ARMY PROCUREMENT RESEARCH OFFICE
OFFICE OF DEPUTY CHIEF OF STAFF FOR LOGISTICS
FORT LEE, VIRGINIA 23801-6045

APRO 86-07
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APPLICABLE CONTRACT TYPES
FOR
GOCO AMMUNITION PLANT PRODUCTION

by

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Information and data contained in this document are based on input available at time of preparation. This document represents the views of the author(s) and should not be construed to represent the official position of the United States Army.

The pronouns "he," "his," and "him," when used in this publication represent both the masculine and feminine genders unless otherwise specifically stated.

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EXECUTIVE SUMMARY

A. BACKGROUND. Currently there is a controversy regarding the appropriateness of using fixed-price contracts at the Government-Owned Contractor-Operated (GOCO) Army Ammunition Plants (AAP). One school of thought believes the Government will derive benefit from transitioning the current cost-type contracts to fixed-price contracts. The other school of thought disagrees, primarily because the conditions necessary for the use of fixed-price contacts do not exist.

B. STUDY OBJECTIVE. The objective of this study is to examine and analyze the GOCO contracting environment insofar as it relates to contract type and to comment upon the advisability of utilizing cost-type or fixed-price contracts.

C. STUDY APPROACH. The study approach included examining how well GOCO ammunition production requirements meet the established criteria for use of fixed-price contracts. The firmness of the requirement and the likelihood and the magnitude of change (requirement instability) were of central importance. Additionally, a recent initiative to increase requirement stability was reviewed.

D. SUMMARY AND CONCLUSIONS. The current GOCO AAP contracting environment has a high degree of instability and uncertainty. There are a number of factors that contribute to this including the ammunition requirements determination process itself, the use of a large amount of Government-Furnished Material (GFM) and the difficulty in planning for and defining the maintenance and special project tasks.

E. RECOMMENDATION. At this time none of the AAPs with cost-type contracts should be transitioned to fixed-price contracts. Very limited future application of fixed-price contracts may be possible, but only in narrow circumstances and only when requirement stability is achievable.

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont'd)

LIST OF FIGURES

LIST OF TABLES

CHAPTER I

INTRODUCTION

A. BACKGROUND/PROBLEM STATEMENT.

Currently there is a controversy regarding the appropriateness of utilizing fixed-price contracts at the Government-Owned Contractor-Operated (GOCO) Army Ammunition Plants (AAPs). One school of thought holds that fixed-price contracts are generally inappropriate for a number of reasons, the primary ones being uncertainty in fixing the scope of work (SOW) and changes to the production schedules. The opposing school of thought believes that the operating contractors at the GOCO AAPs are inefficient and switching to firm-fixed price (FFP) type contracts which should generate lower prices. Two recent studies have been done in this subject area, and the conclusions reached are in opposition to one another. The Army Procurement Research Office was tasked to examine and comment upon the question of appropriate contract type for the operation of GOCO AAPs.

B. SCOPE.

GOCO AAP contracts normally cover two major tasks. One is the operation and maintenance (including special projects) of the government-owned facilities and the other is the actual production of ammunition and/or ammunition components. This study will place primary emphasis on the contract type appropriate for the production task. The operation and maintenance tasks will only be examined tangentially. Unless specifically stated otherwise, all commentary in this report on GOCO contract types will only refer to the production tasks. Mobilization was not a consideration.

While the ammunition requirements determination process has a massive influence on the contracting environment, this study focuses on the effects of that process rather than the process itself.

C. OBJECTIVE.

The objective of this project is to examine and analyze the GOCO contracting environment insofar as it relates to contract type and to comment upon the advisability of utilizing cost-type or fixed-price contracts.

D. METHODOLOGY.

The study approach was oriented toward determining how well the GOCO ammunition production requirements meet the established criteria for fixed-price contracts. The firmness of the requirement and the likelihood and magnitude of change (requirement instability) were of central importance. The information provided by recent studies was examined and analyzed.

During site visits to two GOCO AAPs, production stability data was collected and interviews were conducted with the Contracting Officer's Representative (COR) staff and corporate officials and working level representatives of the operating contractors. From the information obtained, preliminary findings were drawn. Those findings were then discussed with knowledgeable and responsible U.S. Army Armament, Munitions and Chemical Command (AMCCOM) personnel. This approach permitted the researchers to then generalize the findings, where appropriate.

This approach also addressed a new initiative that attempts to minimize the number of monthly changes to the GOCO AAP contracts. Although at present little data exists to evaluate since the implementation of this initiative is very recent, its probable impact on the contracting environment is discussed.

E. ORGANIZATION.

This report is divided into six chapters. Chapter I is the introduction and provides background information on the project tasking and the approach taken. Chapter II presents a brief overview of the GOCO AAP system. Chapter III provides synopses of two recent examinations of GOCO contracting practices performed by the General Accounting Office (GAO) and by Headquarters, Army Materiel Command (AMC). Also, Chapter III identifies the major issues surrounding the GOCO contract-type controversy.

Chapter IV examines the basis for the "contract-type" decision from both the theoretical and the regulatory guidance perspectives. Chapter V presents information on the requirements stability of the actual contracts. Included is historical quantitative data. Chapter V also comments on the new "six-month firm schedule" initiative currently being tested at AMCCOM. The conclusions and the study objectives are addressed in Chapter VI.

Because the audience for this report is made up of highly experienced acquisition professionals, it will be assumed that the reader has a working knowledge of contract types and is aware of the implications associated with the use of fixed-price or cost-type contracts.

CHAPTER II

THE GOCO AAP SYSTEM

A. OVERVIEW.

The GOCO AAPs are essentially government-owned manufacturing facilities that, under the management of a private contractor, produce various types of ammunition. Typically, the facilities at the active plants (there are inactive plants not currently producing ammunition) are specialized to the extent that specific plants have capabilities that allow them to perform only certain tasks related to ammunition production. There are "propellant" plants which have the mission and capability to produce a variety of explosives and propellants. There are "metal parts" plants which only have that mission and capability. There are "load, assemble and pack" (LAP) plants that are primarily responsible for assembling the final end item. Some LAP plants also have metal parts manufacturing capabilities. There are interrelationships and interdependencies between the plants since components or propellant produced at one plant must be shipped to LAP plants for integration into end items. Due to specialized capabilities and different steps in the manufacturing process, sometimes components must be shipped back and forth between the LAP plants. Any material produced at one GOCO (and accepted by the government) and shipped to another is considered to be government-furnished material (GFM) at the receiving plant. Also, the government contracts directly with many commercial firms (non-GOCOs) for component parts of ammunition rounds. When these components are shipped to LAP plants, they become GFM. The implications of this GFM will be discussed later.

B. PROCUREMENT PHASES.

In order to achieve clarity in this discussion, it is helpful to think of the ammunition acquisition process as a three phase process. There is the requirements determination phase that is the responsibility of the customer (Army, Navy, etc.). That is followed by the acquisition, or contracting phase, which is the responsibility of AMCCOM. Finally, there is the actual production phase where a contractor assumes responsibility. Although the phases are performed in the sequence listed above, explanations of the phases, provided below, are given in a different order that aids in understanding the entire process.

1. Acquisition Phase.

AMCCOM is responsible for managing the GOCO AAPs and for acquiring most conventional munitions used by the Army and common-use ammunition used by the other military services and foreign customers (under security assistance programs). Additionally, AMCCOM services other customers which include, but are not limited to, the Treasury Department, Department of the Interior and the Immigration Service Border Patrol.

DA Pamphlet 700-16, The Army Ammunition Management System, provides an excellent general overview of the ammunition procurement process. It states:

> "Although ammunition requirements and budget programs are expressed as complete rounds, most items, except for small arms ammunition, are procured as components. The production organization breaks the rounds into procurable elements (typically, the projectile, fuse, cartridge case, propelling charge, explosive, primer). The procurement organization formulates contracts with government-owned contractor-operated (GOCO) plants and with private industry, while the production organization directs work at government-owned government-operated (GOGO) plants. In general, metal parts are procured from the private sector, and the production of propellants and explosives and load, assembly, and pack

(LAP) is accomplished at government facilities; however, propellant may be obtained from industry, or metal parts from GOCO plants. The selection, in cases where multiple sources (both within the government and in private industry) are available to produce an item, is based on plant workloading and scheduling considerations, maintenance of the mobilization base, and economic considerations. An economic analysis of the sources is conducted to determine the low cost-mix, and the economic solution is evaluated against non-economic factors, such as new item requirements, modernization, mobilization, skill retention, and personnel impact."[1]

The acquisition phase, while somewhat complex in practice, is still rather straightforward and easy to understand in comparison with the requirements determination phase, which is discussed below.

2. Requirements Phase.

DA Pamphlet 700-16 , The Army Ammunition Management System, goes into much detail concerning the Army's requirements determination process. Paragraph 3-4d(3)(a), "Changing Ammunition Requirements," addresses the crux of the matter, the stability of the requirements. That paragraph explains:

"Another part of the production base issue in peacetime is fluctuating requirements and the effect on requirements of revised/updated threat (size, sustainability, weapons/munitions, warning time and buildup rate), OSD guidance (duration of conflict, allies assumptions, production bases constraints) and Army plans (force structure, deployment sequence, POMCUS size, and weapons/munitions). This creates a continuously changing environment causing widely fluctuating requirements for ammunition production. Uncertainty as to availability of new developmental weapons and their relative lethality further complicates the requirements picture as well as the problem of balancing standard ammunition stocks and lead-time constrained base resources."[1]

The Department of the Army (DA) requirements determination process is a highly complex interactive process between a number of different elements in DA and the Office of the Secretary of Defense (OSD). The budgeting process and congressional authorizations and appropriations are an integral part of this process. Since the Army is responsible for the acquisition of selected conventional ammunition for the other services and certain other customers, it is cast in the role of a service organization and must remain responsive to the customers' needs, whether they remain stable or change.

3. Production Phase.

This final phase of the ammunition procurement process is simply the production of the items AMCCOM contracted with the GOCO AAP operating contractors to produce. This phase should theoretically begin after the requirements are determined and a contract is awarded. In practice, however, this phase often appears to be done (to some extent) concurrently with the requirements determination phase.

C. SUMMARY.

The GOCO AAPs are one component in the overall Army Ammunition Management System. The degree of stability with which they operate is largely dependent upon the ammunition requirements determination process.

From a review of Army doctrine regarding the ammunition production requirements determination process, one can see that a degree of instability is inherent in the process. How much and to what degree that instability exists and its influence on the contract type are questions that Chapter IV and Chapter V of this research attempt to answer.

CHAPTER III

RECENT STUDIES AND MAJOR ISSUES

A. INTRODUCTION.

While for a long time there have been ongoing discussions as to the proper contract types AMCCOM should use for acquiring the services of a contractor to operate a GOCO AAP, this project focuses on current issues relating to contract type. These issues emerged from two recent examinations of the GOCO AAPs, one by the General Accounting Office (GAO) and the other by Headquarters, U.S. Army Materiel Command (AMC). On the surface these examinations took opposing views. GAO concluded that cost-type contracts are appropriate, while HQ, AMC, held that fixed-price contracts should be used. Currently, all of the active GOCO AAPs, except Scranton, operate under cost-type contracts. Scranton AAP has a fixed-price contract for production and a cost-type contract for plant operation and maintenance. The purpose of this chapter is to identify the main issues, to present the opposing views and to examine and comment upon the methodology that was employed to obtain the conclusions reached.

B. GAO STUDY.

The GAO study, completed in November 1984, was performed at the request of Senator Carl Levin, Ranking Minority Member of the Subcommittee on Preparedness, Committee on Armed Services. He requested a review of the types of contracts being used in the GOCO AAPs and the extent of competition for them. In addition, a comparison of the Army's contracting methods and the methods used at similar facilities for the other services was also requested. Only those portions of that report which are concerned with contract type will be addressed. The main objective of the contract type portion of the GAO

study was to assess the appropriateness of the types of contracts the Army uses to operate its GOCO AAPs.

The GAO concluded that the Army, in using a variety of cost-reimbursement contracts, is using the appropriate contract types. They stated:

> "We believe the prevailing contracting environment under which the Army's GOCO plants operate lacks, in most cases, the conditions necessary for firm-fixed price contracting. The major impediment is the procurement activity's inability to determine a fixed scope of work. This appears to be attributed largely to uncontrollable factors. These factors include the volatility of product requirements, delays and reprogramming of funds, and problems with receipts and quality of government-furnished materials."[25]

GAO added that many of the uncertainties are beyond the control of AMCCOM and appear to be the product of many complex issues and systems impacting on determining procurement requirements. GAO did not analyze those issues stating they were beyond the scope of their project.

GAO's methodology included comparison of GOCO contracting practices as done by other services, review of contract files, negotiation records and production schedules, and interviews with AMCCOM and GOCO plant personnel. At the Iowa and Radford plants, GAO interviewed personnel and gathered data to determine the feasibility of fixed-price contracting.

GAO stated that the report was conducted in accordance with generally accepted auditing standards except for selected product cost data and information obtained on other service's GOCO contracts. That data was not verified by documentation.

C. AMC HQ EXAMINATION.

This examination, conducted primarily by the Pricing Branch of the Assistant Deputy Chief of Staff for Procurement and Policy and Analyses, Deputy Chief of Staff for Procurement, HQ AMC, did not result in a formal final report. It was more on the order of a compilation of a number of trip reports submitted by pricing personnel. These trip reports covered every active GOCO plant (and one inactive plant). The final product of this examination appeared to be a set of briefing charts and a number of issues which AMCCOM was asked to comment upon.[20]

The scope of this GOCO examination included a review of the accounting systems, the estimating systems, contractor management controls and government management controls. The primary emphasis was not placed upon contract-type. Extracts of all the contract-type related comments from the trip reports for the active GOCO AAPs are included in Appendix A.

In the briefing charts relating to contract type, the conclusions and recommendations of the AMC examination held that "Since all contractors are considered grossly inefficient, a switch to FFP should generate lower prices." [26]

The AMC examination recognized the need to stabilize production schedules before the GOCO contracts could be transitioned to fixed-price. In this regard it was suggested that AMCCOM set a cut-off date for the receipt of requirements and funding.

Backup data provided the APRO by AMC pricing personnel and discussions with the principals of the AMC examination revealed that the conclusions reached, in regard to contract type, were not thoroughly supported by the data collected and did not recognize some existing realities. For example, the conclusions and recommendations assume, incorrectly, that AMCCOM has more

control over the requirements determination process than AMCCOM actually does. Furthermore, the AMC examination does not recognize that many of the other obstacles related to stabilizing production schedules are outside the direct control of AMCCOM.

D. OTHER ISSUES.

The primary issue relating to the appropriateness of using FFP contracts is the production stability factor. There are other secondary, yet important issues that must also be addressed. These issues are introduced below and are examined in the following chapters.

The final end items produced at the GOCO AAPs are often assembled from a number of component parts. Almost all of these parts are GFM. Late deliveries and/or defective GFM can and do impact the stability of production schedules.

All the active GOCO plant operators have two major tasks. There is the actual production task (manufacturing propellant, fabricating metal parts and/or loading projectiles) and there are operations and maintenance tasks related to caring for the actual physical facility and other government property. Related to the operations and maintenance tasks are the "special projects." An example may be a modernization effort undertaken to replace old production facilities. The scopes of work and the planning for the operations, maintenance and special projects will become a significant issue if contracts were transitioned to FFP.

CHAPTER IV

THE CONTRACT-TYPE DECISION

A. INTRODUCTION.

The contract-type decision is a rather simple decision in and of itself. Section 16 of the Federal Acquisition Regulation (FAR) provides fairly good guidelines for a contracting officer to use when making that decision. The difficulty in the contract-type decision lies not in the decision itself, but in clearly identifying various aspects of the technical and business environment that surround the subject acquisition. Those aspects are primarily uncertainty, risk (defined herein as the hazard or chance of loss), and contractor motivation. Once the level of uncertainty (and where possible, the actual uncertainties involved) and the resultant risk have been ascertained, and the contractor's motivation in the instant acquisition evaluated, the general contract-type (cost-reimbursement or fixed-price) called for is usually evident.

An additional factor that enters into the specific contract-type decision is the contractor's preference. FAR recognizes this by stating that selection of contract type is generally a matter for negotiation. FAR 16.103 states:

> "Negotiating the contract type and negotiating prices are closely related and should be considered together. The objective is to negotiate a contract type and price.....that will result in reasonable contractor risk and provide the contractor with the greatest incentive for efficient and economical performance."[24]

This chapter will examine the guidance that establishes the criteria for the contract-type decision.

B. CONTRACT RISK.

1. Types of Risk

The most important concept in contract-type selection is "Risk." The Army Logistics Management Center (ALMC) located at Fort Lee, Virginia teaches its students that the major risk factors to be considered in selecting the proper contract type are technical risk, production risk, and cost risk. For the purposes of this report the different risks are considered interdependent. The contract type will determine the proportion of these risks to be borne by the government and the proportion to be borne by the contractor.[3]

2. Fixed Price Contract Risk

a. At one extreme there is the FFP contract where the contractor bears 100% of the risk. This means that the contractor must deliver supplies and/or services (the design or performance specifications must have been reasonably definite) to the government at an agreed upon time for a specified firm price that was established at the inception of the contract.

b. FAR 16.103(b) requires that an FFP contract be used when the risk involved is minimal or can be predicted with a reasonable degree of certainty. This paragraph goes on to state that when a reasonable basis for firm pricing does not exist, other types of contracts should be considered.

3. Cost Reimbursible Contract Risk

a. Under a CPFF contract, as the other extreme, the government bears 100% of the risk. In this arrangement the contractor is reimbursed for the costs he incurs in attempting to meet the government's requirements. In addition to reimbursement, he also receives a fee agreed upon at the inception of the contract. Under a CPFF contract, the contractor may proceed with performance even though the scope of work is vague and the specifications are indefinite.

b. FAR 16.301-2 states that cost-reimbursement contracts are "suitable for use only when the uncertainties involved in contract performance do not permit costs to be estimated with sufficient accuracy to use any type of fixed-price contract."

4. Risk Continuum

a. In between the two extremes of contract types discussed above, there is a variety of other types of contracts; however, they all fall within either the fixed-price family or the cost-type family. The criteria for a reasonably firm scope that applies to FFP contracts also applies to all contract types within the fixed-price family. When the criteria for a fixed-price contract are not met, a form of cost-type contract is the alternative. ALMC uses a risk line to depict the concept of risk and the appropriate contract type for the degree of risk involved.

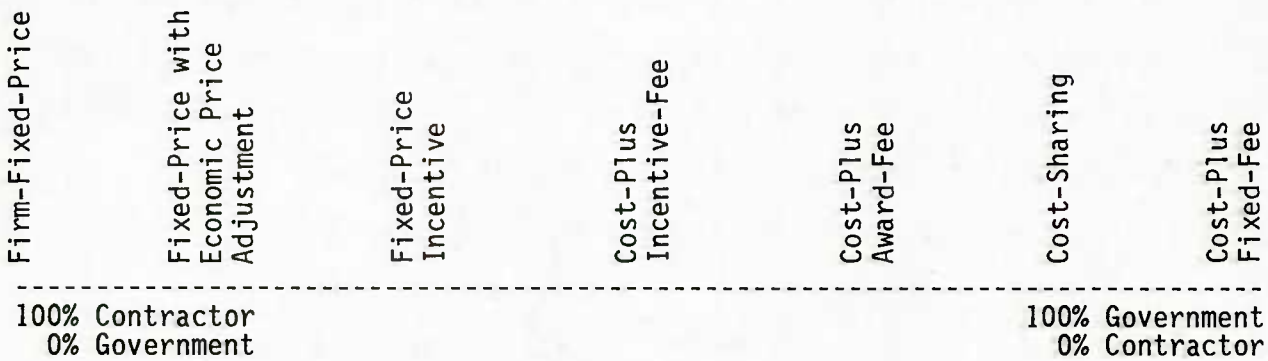

Figure 1. Risk Line

b. On a theoretical basis, the contract price is more sensitive to contract risk than contract-type. As a concrete example of that concept, one might assume that a specific endeavor involves a high degree of risk. If that endeavor was contracted on an FFP basis, the risk would be borne by the contractor. However, the cost of that risk (cost of the uncertainties associated with contract performance) would have to be included in the total FFP contract price. This cost can be referred to as the risk premium. The lesser the uncertainty, the lesser the risk and therefore, the lesser the risk premium charged to the Government. Conversely, the greater the uncertainty, the greater the risk, the greater the risk premium. Under a FFP contract, a prudent contractor would include estimated costs to cover the potential uncertainties (risks) involved in contract performance. Therefore under a FFP contract, the Government may be paying the contractor for contingencies (uncertainties) that may or may not materialize. If the same endeavor were contracted for under a cost-reimbursible contract, a different pricing structure would be negotiated.

c. Under a cost-reimbursible contract, the Government would only pay for the actual costs of the uncertainties that had materialized. It is because of this difference in pricing contingencies that the government may sometimes determine that a cost-type contract is likely to be less costly than a fixed-price contract when a great deal of uncertainty exists.

5. Risk Theory

a. An important theoretical concept that appears to be widely misunderstood is that the party that has the greater degree of control over the risk and uncertainty is the party that should assume the greater contractual risk. If the risk in an endeavor lies mainly in the actual production of an item (assuming the existence of proved specifications), the

government should assume little or no risk since it does not have control over that risk area. The contractor has control over that risk, and therefore, he should assume the majority of risk in any resulting contract. In this example, the contractual risk is placed with the party that has the most control over the expected risk factors (production process).

b. On the other hand, when there is a great performance risk due to uncertainty of the government's requirements, the government should bear the higher (or total) proportion of risk. In sum, this risk-sharing concept simply states that the economic risks inherent in contract performance should be equitably proportioned between the contracting parties in relation to the degree of control the parties are capable of exercising over the risk. In the instant examples, the government does not control the production process of the contractor (contractor controls risk of performance) and the contractor does not control the degree of certainty in the government's requirements (government controls risk of performance).

C. GUIDANCE - FIXED-PRICE CONTRACTS.

When discussing the applicability of fixed-price contracts, FAR provides specific guidance. An FFP contract is appropriate when fair and reasonable prices can be established at the outset and performance uncertainties can be identified and reasonable estimates of their cost impact can be made. There are other contract types in the fixed-price family, but all require that the uncertainties involved in contract performance do not present an obstacle to making a reasonably accurate estimate of costs. If the uncertainties do not permit a reasonably accurate estimate, a cost-reimbursement contract is to be used.[24]

The Armed Services Pricing Manual (ASPM) provides some insight into what is considered an acceptable level of uncertainty for the use of fixed-price

contracts. ASPM states that while uncertainty should not rule out fixed-price contracts, their use necessitates an ability to identify the specific areas and degree of uncertainty. Also, the uncertainties must be relatively few in number.

D. SUMMARY.

The FAR (and other) guidance is reasonably clear insofar as it addresses the general type of contract to use in differing situations. Where the uncertainty (risk) is at least somewhat measurable and the risk of performance is properly placed upon the contractor, some form of a fixed-price contract should be appropriate. Where the uncertainty is not reasonably measurable and the risk associated with that uncertainty properly lies with the government, some form of a cost-type contract is appropriate.

CHAPTER V

ANALYSIS OF ISSUES

A. INTRODUCTION.

This chapter analyzes the issues relevant to the contract type decision. The central issue is the instability of requirements. Army doctrine recognizes the instability inherent in the ammunition requirements determination process. Government and contractor personnel interviewed at both RAAP and LSAAP view the instability first hand. The contracting personnel at AMCCOM attest to the instability seen from their perspective. Up to this point in the report, all commentary on the existing instability has been based primarily upon qualitative data. One purpose of this chapter is to present the quantitative findings of this research. Those findings consist of data from the contractual production schedules from RAAP and LSAAP for 1983, 1984 and 1985; data from initial tests of the "six-month firm schedules" for the period of April 1986 - September 1986 at Iowa AAP, Milan AAP and Holston AAP; and information from two recent stability studies performed by AMCCOM. Also, the results of extensive interviews with government and contractor personnel will be presented (see Appendix B).

B. RAAP AND LSAAP.

The data collected from both RAAP (Tables 1, 2, and 3) and LSAAP (Tables 7, 8, and 9) were obtained during site visits in September 1986. The data was extracted from reports for 1983, 1984 and 1985 that showed the quantities (either pounds or items) programmed for production at the beginning of the one-year contract periods (which coincide with the calendar year). Also extracted from the same reports were the quantities that were actually produced by the contractor at the conclusion of the contract period.

Additionally, selected items from the monthly AMSMC Form 501, Production/Acceptance Schedule, were tracked for a 12-month period to determine the actual number of changes that occurred during calendar year 1985 at both RAAP and LSAAP.

The reasons for the changes could not be determined from the data available to the researchers. It was the researchers' understanding that data which documents the specific reason for each and every change to the production schedule is not maintained. Many of the changes are made as the result of telephone conversations between AMCCOM, the COR staff, and GOCO AAP operating contractors. The only empirical data encountered that discusses the reasons for changes is a 1986 study that was limited to McAlester AAP. That study found that the major reasons for schedule changes (and the percentage with which those reasons accounted for changes) were:

Shortage of Raw Materials, Including GFM/GFE	(46.76%)
Manpower Balance (up or down)	(15.83%)
Other (funding, clerical error, etc.)	(15.83%)
Adjustments to a Realistic Production Rate	(14.39%)
Originated by Other Plants (excluding materials provided)	(7.19%)

Based upon the above figures, it can be seen that the major reason for changes to the production schedules (according to this study) were problems related to materials, and it is believed most of these changes stem from GFM/GFE. This theme was repeatedly heard from the contracting people at AMCCOM.

1. RAAP

Tables 1, 2, and 3 show the items produced at RAAP during CY 1985, 1984 and 1983, respectively, that were required by the government at the time the contractor submitted a proposal and then subsequently produced by the

contractor. Requirements for those calendar years that were unknown at the time a proposal was submitted, yet later added, are shown in Tables 4, 5, and 6.

In Tables 1 through 3 the "Proposed Quantity" is the quantity (items or pounds) for which the GOCO operating contractor submitted a proposal. This required quantity was arrived at jointly between the actual customer (for example, Army, Marine Corps, etc.) and AMCCOM. The "Actual Quantity" is the total amount produced by the end of the contract period being examined. The next column, "Diff.", is the total difference (+ or -) between the proposed quantity and the actual quantity produced. While the reasons for these differences may vary (e.g., late GFM, change in funding, etc.), their effect is the same in terms of the instability they cause. The following column, "Percent Diff.", gives the absolute value of the percent difference between the proposed quantity and the actual quantity produced.

The column "No. of Changes", found only in the data for 1985 (Table 1), shows the total number of schedule changes that each of the surveyed items experienced during the 12-month production (contract) period. Due to time limitations while on-site, only a sample of the items were surveyed. These changes are extracted from the AMSMC Form 501 provided monthly to the contractor from AMCCOM.

Tables 4 through 6 show items produced at RAAP for calendar years 1985, 1984, and 1983, respectively, for which a requirement did not exist at the time the operating contractor submitted a proposal. The requirements for these items were added after the proposal was submitted, either during negotiations or during contract performance.

Table 1
RADFORD PRODUCTION ITEMS (1985)

ITEM	PROPOSED QUANTITY	ACTUAL QUANTITY	DIFF.	PERCENT DIFF.	NO. OF CHANGES
TOW FLIGHT	12000	10632	-1368	11.4000	
RAP AFT	80000	84957	4957	6.1962	
RAP FWD	80000	84558	4558	5.6975	0
RAP 8	48000	28551	-19449	40.5187	10
TOW IGN II	33900	27461	-6439	18.9941	
TOW IGN I	8364	7323	-1041	12.4461	
TOW LAUNCH - M.L.	26439	24622	-1817	6.8724	
BENITE	127325	118892	-8433	6.6232	12
M6+2 F/76mm	38000	0	-38000	100.0000	
M9 FLAKE, F/4.2, M36A1	6888	0	-6888	100.0000	
M30A1 SLOTTED STICK	850000	0	-850000	100.0000	
MK 90 GRAIN MFG	15000	0	-15000	100.0000	
M1 MP F/M4A2	900000	0	-900000	100.0000	
M36A2 F/4.2	207000	192652	-14348	6.9314	11
M36A1 F/4.2	82000	190433	108433	132.2353	
M1, SBSP, 155mm, M3A1	2700000	3008580	308580	11.4288	6
BS-NACD F/S	900000	1703230	803230	89.2477	1
Ign. Pwd (CBI)	486000	358125	-127875	26.3117	5
M6 SBMP F/155mm, M119	27150000	22119615	-5030385	18.5281	10
M14 F/M490	5400000	1626060	-3773940	69.8877	5
M1 F/105mm, M724	4050000	4500970	450970	11.1350	2
M2, SP, 019, F/40mm	101000	101543	543	0.5376	
B31A1, F/8, M188E2	9500000	8997740	-502260	5.2869	9
M30, F/105mm, XM833	1200000	607390	-592610	49.3841	5
M9 Flake, F/40mm, .003	3487	4912	1425	40.8660	
M5 Flake, SPC. APPL.	1703	2630	927	54.4333	
M10 Flake, F/155mm/8	74000	174920	100920	136.3783	3
M10 Flake, F/81mm, .014	15000	40720	25720	171.4666	
M9 Flake, F/4.2, M36A2	1780	7347	5567	312.7528	
M10 Flake, F/60mm, M720	52800	140540	87740	166.1742	4
IMR 4895	45000	41030	-3970	8.8222	
IMR 5010	728000	437710	-290290	39.8750	12
NC F/NOS ALC. Wet	275000	203199	-71801	26.1094	
NC F/EFMC, Water wet	253000	339600	86600	34.2292	
			AVE % DIFF	56.1325	
			AVE NO. CHANGES		6.33

Table 2
RADFORD PRODUCTION ITEMS (1984)

ITEM	PROPOSED QUANTITY	ACTUAL QUANTITY	DIFF.	PERCENT DIFF.
Tow Flight	12000	12009	9	0.0750
RAP AFT	99000	97102	-1898	1.9171
RAP FWD	99000	96774	-2226	2.2484
RAP 8	48000	46725	-1275	2.6562
Tow IGN. II	27000	23184	-3816	14.1333
Tow IGN. I	8000	7000	-1000	12.5000
Tow Launch - M.L.	24000	24057	57	0.2375
Benite	120336	120456	120	0.0997
M180	600	498	-102	17.0000
N5 F/Navy	200000	406022	206022	103.0110
NOSIH-AA-2	570000	695886	125886	22.0852
NOSIH-AA-6	330000	642653	312653	94.7433
NOSIH-AM-2 C.R.	34000	31295	-2705	7.9554
HEN-12 C.R.	10000	16322	632	63.2200
NOSOL 318 C.R.	24000	11396	-12604	52.5166
M36A2 F/4.2mm	370000	321378	-48622	13.1410
M36A1 F/4.2	48000	60025	12025	25.0520
M1, SBSP, 155mm, M3A1	102000	701975	599975	588.2107
BS NACO F/5	2029000	1419410	-609590	30.0438
Ign Pwd (CBI)	296000	495200	199200	67.2972
M6+2 F/76mm	384000	292730	-91270	23.7682
M6 SBMP, F/155mm, M119	16650000	25066290	8416290	50.5482
M1, F/105, M724	1714000	2714470	1000470	58.3704
M2, SP, 019, F/40mm	21000	46915	25915	123.4047
M30 F/105mm, M490	6500000	9063770	2563770	39.4426
M31A1, F/8, M188E2	9900000	7635270	-2264730	22.8760
M30, F/105mm, XM833	1442000	1451595	9595	0.6653
M9 Flake, F/40mm, .003	11000	7295	-3705	33.6818
M5 Flake, SPC. APPL., .005	2455	3585	1130	46.0285
M10 Flake, F/155mm/8	148000	83910	-64090	43.3040
M10 Flake, F/81mm, .014	150000	225440	75440	50.2933
M9 Flake, F/4.2, M36A2 .005	35000	31911	-3089	8.8257
M10 Flake, F/60mm, M720, .008	107700	130260	22560	20.9470
M9 Flake, F/M185, .022	108000	126230	18230	16.8796
IMR 5010	1200000	884420	-315580	26.2983
NC F/NOS, Alc. Wet	264000	240750	-23250	8.8068
NC F/EFMC, Water wet	87000	191700	104700	120.3448
N-12 C R	10000	0	-10000	100.0000
M14 F/M490	625000	0	-625000	100.0000
NOSOL 318 FLAKE	12000	0	-12000	100.0000
M30 F/105mm, M456A2	1500000	0	-1500000	100.0000
M9 FLAKE, F/4.2, M36A1	12000	0	-12000	100.0000
M9 FLAKE, F/81mm, M299	12000	0	-12000	100.0000
M9 FLAKE, F/60mm, M720	3000	0	-3000	100.0000
M9 FLAKE, F/81mm,	7000	0	-7000	100.0000
IMR 4895	38000	0	-38000	100.0000
		AVE % DIFF		58.9702

Table 3
RADFORD PRODUCTION ITEMS (1983)

ITEM	PROPOSED QUANTITY	ACTUAL QUANTITY	DIFF.	PERCENT DIFF.
TOW FLIGHT	12000	12003	3	0.0250
RAP AFT	120000	89837	-30163	25.1358
RAP FWD	120000	89833	-30167	25.1391
RAP 8	30000	28734	-1266	4.2200
Tow Launch - L.M.	24000	24356	356	1.4833
Benite	120000	123124	3124	2.6033
MK43	153000	239980	86980	56.8496
NOSIH-AA-2	600000	583957	-16043	2.6738
NOSIH-AA-6	238000	274174	36174	15.1991
NOSIH-AA-2 C.R.	40000	42762	2762	6.9050
M36A2 F/4.2mm	124600	275255	150655	120.9109
M36A1F/4.2	150000	3211	-146789	97.8593
BS NACO F/5	1575000	885430	-689570	43.7822
Ign Pwd (CBI)	350000	205492	-144508	41.2880
SB M6+2	573000	364670	-208330	36.3577
M6, M119	12400000	12834155	434155	3.5012
M1, F/105, M724	8077000	5332200	-2744800	33.9829
M30 F/105mm, M490	1800000	1517845	-282155	15.6752
M31A1, F/8, M188E2	9200000	5759645	-3440355	37.3951
M30, F/105, M774	1500000	1991835	491835	32.7890
M30, M833	400000	498438	98438	24.6095
M9 Flake	19000	3070	-15930	83.8421
M5 Flake	1000	1905	905	90.5000
M10 Flake	140000	124120	-15880	11.3428
M9, .006, F/36A2	12000	17488	5488	45.7333
IMR 4895	46000	71170	25170	54.7173
IMR 8097 F/7.62	23000	8290	-14710	63.9565
NC to NOS	88000	230660	142660	162.1136
NC F/EFMC Grade A	216000	149700	-66300	30.6944
NC Lint F/ARMTEC	24000	5175	-18825	78.4375
HEN-12 C R	5000	0	-5000	100.0000
SBMP M1 M393A2 M416	1800000	0	-1800000	100.0000
M10, M374A213, M375A2	34000	0	-34000	100.0000
M10, 60mm, M720	12000	0	-12000	100.0000
M9, F/M299 IGN CART	12000	0	-12000	100.0000
		AVE % DIFF		49.9920

Table 4
RADFORD PRODUCTION ITEMS 1985
ADDED DURING NEGOTIATIONS OR PERFORMANCE

NO.	ITEM	QTY PRODUCED	WHEN ADDED
1	M180	1631	performance
2	N 5 F/Navy	0	performance
3	NOSIH AA-2 C.R.	386836	performance
4	NOSIH AA-6 C.R.	977668	performance
5	NOSIH AM-2 C.R.	12575	performance
6	HEN-12 C.R.	11195	performance
7	NOSOL 318 C.R.	23010	performance
8	M2, SP, 019, F/40mm	101543	performance
9	NOSOL 318 Flake	6639	performance
10	M30, F/105mm, M490	2494591	performance
11	M10 Flake, F/81mm, .014	40720	performance
12	M9 Flake, F/81mm, M299, .018	10218	performance
13	M9 Flake, F/81mm, .012	8715	performance
14	M9 Flake, F/M185, .022	1415	performance
15	M30 Reblend and Repack	508849	performance
16	EC Grain 686.5 F/NOS	42500	performance
17	Subcal. Law M73	528434	performance
18	M30 F/105mm, M735	151315	performance
19	Remelt TNT	0	performance
20	Subcal. Law, M73 Rework	0	performance
21	M9 F/M90 Chg A	3500	performance
22	Curing MK 43 Grains	24238	performance
23	Pack Benite for Egypt	3220	performance
24	NOSIH AA-2 C.R. Replacement	143052	performance
25	IMR 4903	10390	performance
26	Reblend M30 F/M200	17243	performance

Table 5
RADFORD PRODUCTION ITEMS 1984
ADDED DURING NEGOTIATIONS OR PERFORMANCE

NO.	ITEM	QTY PRODUCED	WHEN ADDED
1	M30 F/105mm, M774	219695	neg/perf
2	M30 Reblend and Repack	1134465	performance
3	EC Grain 686.5 F/NOS	15500	performance
4	M9 F/M90 Chg A	3500	performance
5	Prop SR 8074 F/7.62mm	1630	performance
6	M30, M456A2 Level A Pack	79350	performance

Table 6
RADFORD PRODUCTION ITEMS 1983
ADDED DURING NEGOTIATIONS OR PERFORMANCE

NO.	ITEM	QTY PRODUCED	WHEN ADDED
1	TOW Ign Grain II	10195	neg/perf
2	TOW Ign Grain	11007	neg/perf
3	N-5 C.R.	317172	negotiations
4	N-12 C. R.	14761	neg/perf
5	M34 Bar Embossed sheet	18429	negotiations
6	25mm Bushmaster	197733	neg/perf
7	M30A1, M203	637470	neg/perf
8	M30, M735	299591	neg/perf
9	M30, M456A2	1664868	neg/perf
10	M180	205	performance
11	MISP f/155mm M3A1	577150	performance
12	IMR 5010	337510	performance
13	M30, M735 - Level A Pack	0	performance
14	M30, M490	0	performance
15	N-5 Sheet Stock	0	performance
16	M69 Ign F/NASA	75	performance
17	EC Granules	25400	performance
18	MK90	170	performance
19	MK43 - Level A Pack	40004	performance
20	M36 Rod Stock	225	performance
21	M6 M119 Reblend	450315	performance
22	Bushmaster Reblend	47023	performance
23	NOSOL 318	2695	performance
24	M9 F/81mm .022	22965	performance
25	IMR 7641	47	performance

2. LSAAP

Tables 7, 8, and 9 show the items produced at LSAAP during CY 1985, 1984, and 1983, respectively, that were planned for production and then subsequently produced by the contractor. At RAAP, items planned for production were shown at that point in time when the contractor submitted a proposal. At LSAAP, due to the nature of the existing data, the items planned for production are the production requirements at a point in time somewhere between the contractor's proposal submission and the beginning of production, normally a four-six month window. Using this time as the baseline is just as valid as the RAAP baseline point, since the purpose of these tables is to show the stability or instability encountered during production.

Tables 7, 8, and 9 are formatted identically to Tables 1, 2, and 3. To avoid unnecessary repetition, the reader should refer to the explanations of the formats and the data contained in section 1, RAAP.

Table 10 includes the LSAAP data for items that were added during performance of the contracts for CY 1985, 1984, and 1983. Unlike the similar RAAP data in Tables 4, 5, and 6 (that identifies whether items were added during performance or negotiations), the LSAAP data only lists items that were added during contract performance.

Table 7
LONE STAR PRODUCTION ITEMS (1985)

ITEMS	PROPOSED QUANTITY	ACTUAL QUANTITY	DIFF.	PERCENT DIFF.	NO. OF CHANGE
Detonator, Stab, M55	65401400	61484582	-3916818	5.9888	
Spotting Charge F/483A1/M509	47000000	65224	-46934776	99.8612	
Projectile 8, HE,M509A1	201600	147473	-54127	26.8487	
Grenade, XM77	18255000	19084050	829050	4.5414	20
Delay Detonator F/M692/M731	230000	704000	474000	206.0869	2
Lead Cup AssyF/155mmM692/M731	800000	1071200	271200	33.9000	
Primer, Stab, PA505	400000	761000	361000	90.2500	
Detonator, Stab, M59	2611000	2798100	187100	7.1658	
Delay Assy F/8, M650	14575	45940	31365	215.1972	17
Delay Assy F/155mm,M549	10800	4957	-5843	54.1018	
Booster Assembly, PA524	14645	64142	49497	337.9788	
Booster Aux.PA500 F/8, M650	48000	25500	-22500	46.8750	
Primer, Elec, M83	447000	425895	-21105	4.7214	4
Tracer, Proj, M13 Assy	1042500	1157300	114800	11.0119	4
Primer, Elec, M80A1	442100	539321	97221	21.9907	11
Primer, Elec, M120	85856	56232	-29624	34.5042	
Detonator, Stab, M94	1101000	1679447	578447	52.5383	12
Lead Explosive PA510	1251000	1521000	270000	21.5827	
Primer, Perc, M82	635000	1013765	378765	59.6480	16
Primer, Perc, MK2A4	300000	305754	5754	1.9180	
Fuze, M567 W/Boost F/Ctg,81mm	100000	119895	19895	19.8950	
Fuze, M935 W/Boost F/Ctg 60mm	250000	315427	65427	26.1708	14
Detonator, Stab, M76	400000	845250	445250	111.3125	17
Delay Element M53 F/M567 Fuze	400000	1083012	683012	170.7530	23
Lead Assembly F/M567 Fuze	400000	518311	118311	29.5777	
Detonator, SQ, M98	400000	939403	539403	134.8507	18
Primer, Perc, M54	400000	2868821	2468821	617.2052	
Primer, Stab, M26	207000	221042	14042	6.7835	
Charge Burster F/2.75 Rocket	13423	15523	2100	15.6447	10
Primer, Perc., M1B1A2 F/105mm-	109205	100089	-9116	8.3476	
Primer, Perc., M1B1A2 F/105mm	1000	1000	0	0.0000	
Primer, Perc., M28B2	306851	71785	-235066	76.6059	
Primer, Perc., M61	794354	819165	24811	3.1234	
Primer, Perc., M90	10000	10000	0	0.0000	
Fuze, PIBD, M509A2	70141	69800	-341	0.4861	
Detonator, Stab, M99	340000	723563	383563	112.8126	
Delay Element M2 .05 Sec Delay	465120	367120	-98000	21.0698	
Grenade, Hand, Frag, M67	498398	447120	-51278	10.2885	
Relay, M7	165610	165610	0	0.0000	
M1 Activator, AT, Mine	16867	16867	0	0.0000	
Driver, MK22	8983	7638	-1345	14.9727	
Igniter Assy F/Fuze M10A2	300000	0	-300000	100.0000	
Cutter High Exp MK3 MOD 1	2668	0	-2668	100.0000	
Primer Screw Assy,F/MK342 Fuze	9521	0	-9521	100.0000	
Delay Element M2 .025Ser Delay	34000	0	-34000	100.0000	
M3A1 Tracer	440000	0	-440000	100.0000	
LAP CHG Buster F/2.75 RKT	15523	0	-15523	100.0000	
Primer Elec M83 M490/M456A2	32404	0	-32404	100.0000	
CTG 105 MM HE M1	356820	0	-356820	100.0000	
			AVE % DIFF	71.7675	
			AVE NO. CHANGES PER ITEM		12.9230

Table 8
LONE STAR PRODUCTION ITEMS 1984

ITEMS	PROPOSED QUANTITY	ACTUAL QUANTITY	DIFF.	PERCENT DIFF.
Projectile, 155mm, HE, M483A1	13140	14776	1636	12.4505
Projectile, 8, HE, M509A1	216000	96084	-119916	55.5166
Primer,Elec,M80A1 F/Ctg 105mm	300000	369255	69255	23.0850
Primer, Perc, M82	516078	613080	97002	18.7959
Primer, Elec, M83 M490/M456A2	328000	437460	109460	33.3719
Primer, Elec, M120, M774/M833	103000	211990	108990	105.8155
Primer,Perc, M1B1A2 F/105mm	71671	241339	169668	236.7317
Primer, Perc, M54 F/M567	220000	536325	316325	143.7840
Primer, Stab, PA505 P/N9296892	570000	536290	-33710	5.9140
Primer Stab M26 F/35mm RktPrac	29981	267244	237263	791.3778
Fuze M567 W/Boost Level C Pack	56137	124704	68567	122.1422
Fuze, Prox, M732	939000	283749	-655251	69.7817
Fuze, PIBD, M509A2	76043	204650	128607	169.1240
Fuze M935 W/Booster F/Ctg 60mm	246097	281864	35767	14.5337
Detonator Stab M76 F/M567/M935	210000	474600	264600	126.0000
Detonator, Stab M55	47980800	46250585	-1730215	3.6060
Detonator, Stab, M94	238250	1538790	1300540	545.8719
Detonator, Stab, M99	244331	314520	70189	28.7270
Detonator, Stab, M59	650000	809200	159200	24.4923
Detonator, SQ M98 F/M567 Fuze	210000	377550	167550	79.7857
Delay Element M2 .05 Sec	465200	98000	-367200	78.9337
Del Detonator F/Proj M692/M731	709500	837000	127500	17.9704
Del Element M53 F/M567 Level C	210000	256459	46459	22.1233
Delay Assy F/Proj 8 M650	51867	46257	-5610	10.8161
Delay Assy F/Proj 155mm, M549	98000	94912	-3088	3.1510
Grenade Gen Purpose XM77	12300000	11265292	-1034708	8.4122
Lead Assy F/M567 Fuze	210000	768200	558200	265.8095
Lead Cup Assy F/Proj M692/M731	600000	676000	76000	12.6666
Lead Explosive PA510	1200000	1532052	332052	27.6710
BoosterAux PA500 F/Proj 8 M650	48000	38680	-9320	19.4166
Relay M7	518610	253000	-265610	51.2157
Tracer Projectile, M13 Assy	687000	941200	254200	37.0014
Spotting Charge M483A1/M509	31800	21072	-10728	33.7358
M1 Activator, AT, Mine	317280	343260	25980	8.1883
Cutter High Exp MK3 MOD 1	3668	0	-3668	100.0000
Driver Pwd Actuator MK22 MOD 0	8953	0	-8953	100.0000
Primer Screw Assy F/MK342 Fuze	9521	0	-9521	100.0000
Primer Perc M61	348936	0	-348936	100.0000
			AVE % DIFF	94.9479

Table 9
LONE STAR PRODUCTION ITEMS (1983)

ITEMS	PROPOSED QUANTITY	ACTUAL QUANTITY	DIFF.	PERCENT DIFF.
Projectile, 155mm, HE, M483A1	17739	103337	85598	482.5412
Projectile, 8, HE, M509A1	130000	10	-129990	99.9923
Grenade, General Purpose XM77	2268000	2589239	321239	14.1639
Primer,Elec,M80A1 F/Ctg 105mm	360000	321086	-38914	10.8094
Primer, Perc, M82	1575000	1881374	306374	19.4523
Primer, Elec, M83 M490/M456A2	637400	554875	-82525	12.9471
Primer, Elec, M120, M774/M833	86500	53366	-33134	38.3052
Fuze M567 W/Boost Level A Pack	491327	155399	-335928	68.3715
Fuze M567 W/Boost Level C Pack	593214	424721	-168493	28.4034
Fuze, Prox, M732	764667	861254	96587	12.6312
Detonator Stab M76 F/M564 Fuze	221063	560323	339260	153.4675
Fuze, PIBD, M509A2	200000	53533	-146467	73.2335
Detonator, Stab M55	47864000	35389050	-12474950	26.0633
Detonator, Stab, M94	980100	727055	-253045	25.8182
Detonator, Stab, M99	541600	651603	110003	20.3107
Lead Assembly F/M567 Fuze	70072	242756	172684	246.4379
Supplementary Charge	528670	1061400	532730	100.7679
Delay Element M2 .05 Sec Delay	777774	543654	-234120	30.1012
Relay M7	1216610	651000	-565610	46.4906
Tracer Projectile, M13 Assy	970000	1134772	164772	16.9868
Spotting Charge M483A1/M509	26469	26469	0	0.0000
M1 Activator, AT, Mine	392440	32715	-359725	91.6636
Lead Cup Assy F/Proj M692/M731	511500	864662	353162	69.0443
Delay Detonator M692/M731	811000	858630	47630	5.8729
Lead Explosive PA510	980100	822366	-157734	16.0936
Delay Element M53 F/M567 Fuze	99707	372686	272979	273.7811
Primer Stab PA 505 P/N 9296892	531207	301170	-230037	43.3045
Delay Assy F/Proj 8 M650	44900	30760	-14140	31.4922
Delay Assy F/Proj 155mm M549	49227	105814	56587	114.9511
Booster Aux PA500 F/Proj M650	35500	25146	-10354	29.1661
Driver Powder Actuataor MK22	5650	30	-5620	99.4690
Grenade, Hand, Frag M67	454000	810005	356005	78.4151
Primer Stab M26 F/35mmRkt Prac	74000	74000	0	0.0000
Cutter High Exp MK3 MOD1	3600	0	-3600	100.0000
Fuze XM935 F/60mm	190000	0	-190000	100.0000
DelayElem M2 .025 Ser Delay	32375	0	-32375	100.0000
			AVE % DIFF	74.4597

Table 10
LONE STAR PRODUCTION ITEMS
ADDED DURING CONTRACT PERFORMANCE

NO.	ITEM	QTY PRODUCED
	1985	
1	Grenade, M42 (Mississippi)	1082649
	1984	
1	Primer Perc M28B2 F/Ctg 105mm	390057
2	Detonator Stab M59 Inert	5000
3	Booster Assembly, PA524	61118
	1983	
1	Primer Perc., M61	25349
2	Fuze Base Detonating M578 Rework	28330
3	Detonator, Stab, M59	700000
4	Detonator, Stab, M59 Inert	2000
5	Detonator SQ M98 F/M567 Fuze	396218
6	Primer Perc M54 F/M567 Fuze Delay	315464
7	Primer, MK22 MOD 2 (40mm)	24320
8	Booster Assembly PA524	3040

3. Summary of RAAP and LSAAP Data

The data collected from these two plants shows a high degree of requirement instability during contract performance. Some of the more significant statistical data is noted below.

The average percent difference in quantities produced versus quantities proposed (accounting for both increases and decreases) at RAAP during 1985, 1984 and 1983 were approximately 56%, 59%, and 50%, respectively. These figures exclude 26 items that were added during contract performance in 1985, six items that were added during contract performance in 1984, and 25 items that were added during contract performance in 1983. Each of these added items were produced in varying quantities as shown by Tables 4 through 6. The data for 1985 includes a random sample of several items that were tracked through the performance period of the contract to determine how often these changes occurred. These were changes in either quantity or schedule. Of the 15 items sampled, it was found that each item was changed an average of 6.33 times between the proposal submission and the completion of contract performance. Of the 60 different items either produced or planned for production during 1985 (items in Tables 1 and 4), only 34, or 56%, were identified at the time of proposal submission. For 1984 the corresponding figures were of 52 items produced or planned for production, 46 or 88%, of which were identified at the time of proposal submission. For 1983, 60 items were produced or planned, with 35, or 42%, identified at the time of proposal submission.

The average percent difference in quantities produced versus the quantities required (accounting for both increases and decreases) at the LSAAP baseline point during 1985, 1984, and 1983 were approximately 72%, 95%, and 74%, respectively. These figures exclude one item that was added during

contract performance in 1985, three items added during 1984, and eight items added during 1983. The data for 1985 includes a random sample of a number of items that were tracked through the performance period of the contract to determine how often these changes occurred. These were changes in either quantity or schedule. Of the 13 items sampled, it was found that each item was changed an average of 12.92 times during the performance period of the contract. The stability, in terms of the number of items added during performance, at LSAAP was much greater than at RAAP for the years for which data was collected. Out of 50 items planned in 1985, only one was added during performance, of 41 items in 1984, three were added during performance, and of 44 items for 1983, eight were added during performance.

C. DATA FROM PREVIOUS STABILITY STUDY.

AMCCOM (AMSMC-SAS) performed a statistical analysis of production schedule data for the calendar year 1985 with sample data that represented five AAPs.[17] This study was an analysis that presented statistical inferences about stability. It did not provide qualitative findings and conclusions about the overall degree of stability, as the instant study must. APRO attempted to draw generalized conclusions from the data this AMCCOM study presented. The results of that effort follow.

The monthly AMSMC Form 501, used for production scheduling at the AAPs, is used in such a way that opportunity for changing the quantity and/or schedule of a single line item presents itself at 66 times during a one-year contract. The AMCCOM study selected line items at five AAPs and that provided data which showed the percentage of time changes were introduced into the production schedule in relation to the opportunities for change. For example, if out of the 66 opportunities for change a line item was changed on the average of 51.2 times (as was the case with the selected line items at Milan AAP), the

percentage of change is calculated at 77.6% (51.2 changes divided by 66 opportunities for change). The results of those computations are listed below for the plants that the AMCCOM study surveyed.

Table 11
PREVIOUS STABILITY STUDY DATA

AAP	PERCENT
IOWA AAP	34.8%
INDIANA AAP	37.9%
LONE STAR AAP	37.0%
MILAN AAP	77.6%
RADFORD AAP	20.8%

D. SIX-MONTH PRODUCTION SCHEDULE INITIATIVE.

As an attempt to minimize schedule changes (the reader should note in paragraph C above the opportunity for up to 66 changes per line item during a one-year contract), AMCCOM has developed a semi-annual scheduling initiative. Essentially, this initiative divides the one-year contract into two six-month segments, insofar as scheduling requirements is concerned. The primary intention of the six-month schedules is to allow the contractor greater latitude in the internal scheduling of work and thereby increase plant efficiency. This, in turn, is expected to reduce costs.

At the outset, it was contemplated that this semi-annual scheduling concept would allow the plants to have a single quantity of a line item to produce during the production period rather than six quantities for each of the months within the semi-annual schedule period. Under this concept, the plant would be permitted to schedule work anytime during the production period, provided the end item would meet the customer-required delivery schedules.

Schedule changes within a current production period would be limited to certain criteria which include unprogrammed/unforeseen requirements and non-availability of GFM. If those criteria were not met, required changes would be included in the subsequent production period. In effect, this would mean that instead of monthly changes to current production schedules (those changes that did not meet the criteria for inclusion in the current production period), the changes would accumulate and there would be one relatively large change at the beginning of the subsequent six-month schedule.

This concept was never intended to be used as a way to convert the cost-type contracts into fixed-price contracts. However, on the surface it would appear that stable six-month schedules would remove the uncertainty that inhibits the use of fixed-price contracts. This is not true for a number of reasons that will be noted later. At this point, however, the recent experience of utilizing the six-month schedules will be examined.

As of September 1986, three AAPs involved in the initial "test" of the semi-annual scheduling concept had completed the first six-month segment of their one-year contract. Iowa, Milan, and Holston AAPs were the participants in this initial test. Data was collected for the test period from April 1986 through September 1986. The table below shows the number of items scheduled to be produced at the outset of the six-month production period, the number of changes to those items during the six-month firm schedule, and the percent of the items that were changed. The reasons for the changes are not documented; therefore, that data was not available to the researchers.

Table 12
SEMI-ANNUAL SCHEDULE (TEST)

	IAAP	MAAP	HAAP
Number of items on schedule	43	59	36
Number of changes during period	14	22	2
Percent of the items changed	33%	37%	6%

With the reader bearing in mind that this semi-annual schedule was not devised for the purpose of creating an environment in which fixed-price contracts could be used, it must be noted that even if the instability (due to changing requirements) during a six-month production period could be curtailed, three major impediments to fixed-price contracts would still exist.

The first is the GFM problem discussed earlier where it was shown that in a previous study problems with materials accounted for a large portion of the changes.

The second impediment relates to the point in time at which the first six-month schedule segment (of the one-year contract) becomes "firm." Because this schedule is undergoing refinement almost up until the point a contract is awarded (and according to the initial test data, changes continue to be made during performance), a firm production schedule is not available to the contractor until approximately two weeks before the beginning of the performance period. This does not provide the adequate time for the government to develop a solicitation, for the contractor to submit a proposal, and for evaluation and negotiation of the proposal prior to contract award. This would require a continuance of the current commonly used practice of a proposal being based upon one set of requirements, the negotiations being based upon a changed set of requirements, and the contract award being for a

different set of requirements. This practice is not consistent with the use of fixed-price contracts.

The third impediment is associated with the fact that the GOCO AAP contracts are one-year contracts with only one six-month schedule. A second six-month schedule that will become firm two weeks prior to the contractor starting his mid-year performance does not allow a fixed-price to be determined at the outset of the contract.

It is assumed that many other impediments would still exist; however, the initial test of the semi-annual schedule has not introduced enough stability into the contracting environment to utilize fixed-price contracts.

E. INTERVIEW DATA REGARDING FIXED-PRICE CONTRACTING.

In addition to quantitative findings discussed above, interviews with government contracting personnel at AMCCOM, RAAP, and LSAAP and contractor representatives at RAAP and LSAAP revealed the following picture of stability. The specifics of the interviews that led to this picture are documented in Appendix B. This picture is fairly typical, yet generalized. Some details may differ for the various plants.

Respondents indicated that the contracting environment is highly unstable and remains so from the time a proposal is issued until a contract is actually completed. Changes in items, schedules, and quantities continue throughout the life of a contract, sometimes occurring as often as monthly. They said this continuing instability requires that a contractor's proposal be based upon a set of requirements at a fixed point in time. For the purposes of negotiations, the changing requirements are frozen to establish a baseline. By the time of the actual contract award, the requirements have again changed.

The interviewees believed that if the contracts were changed to fixed-price contracts, most of the COR staffs would not be able to do an

adequate job (at the outset) unless they received additional training. Also, the mix of personnel must undergo a reevaluation in light of the changed administrative needs of a fixed-price environment vis-a-vis a cost-type environment. Fixed-price contracts will serve to double or triple the percentage of fee (profit) the contractor would receive, without a guarantee that the contractor would be able to reduce costs to the government. Simply converting to a fixed-price contract within the current environment does not address the central problems of instability. Moreover, operation and maintenance tasks would suffer since cutting corners to save costs (thereby increasing contractor profit) would, in the long run, increase total plant operation and maintenance tasks.

All interviewees (including the principals of the AMC HQ examination) agreed that a prerequisite for fixed-price contracts is that the quantities, schedules, and items remain reasonably firm for the entire contract period, beginning with the submission of the proposal. However, since this prerequisite does not exist in the current contracting environment, a "what if" fixed-price analysis is premature.

F. MAINTENANCE AND SPECIAL PROJECTS.

Since the scope of this project was focused upon the advisability of using fixed-price contracts for the production tasks at the GOCO AAPs, a comprehensive analysis of the maintenance and special project tasks was not performed. However, during the course of this study it became obvious that the maintenance of facilities and special projects do not, in a great many cases, lend themselves to fixed-pricing.

While grounds maintenance is relatively predictable, major maintenance efforts, including repair and replacement of equipment and facilities, are not. Needs for unplanned maintenance or special projects are not always

capable of being identified far enough in advance for the funding to be obtained in a manner timely enough to be included in the contract before performance must begin. Due to the very nature of the product produced in ammunition plants, the risk of unexpected problems is very high. In addition to the possibility of unforeseen damage, polluted waste water from manufacturing processes must be kept under control. Also, safety and security requirements in the AAP environment must often be dealt with as soon as possible after they are identified. The delay attendant to placing these types of needs on a fixed-price basis (if even possible) is usually unacceptable.

Additionally, a fixed-price contract must have a reasonably firm scope and the nature of many of these efforts does not allow them to be defined in adequate enough detail. At best, these work requirements would be more on the order of time and material efforts if cost-type contracts were not available for use.

Finally, a contractor would be tempted to "cut corners" on fixed-price maintenance efforts since a lower cost would normally result in a higher profit for the contractor. An example given by one of the contractors interviewed concerned roof maintenance. If a fixed sum of money was allocated for maintaining a roof, it would be tempting to use a band-aid fix to minimize the contractor's cost outlay (thereby increasing his profit) when more extensive repairs would be the prudent thing to do. In the long run, the band-aid approach would likely be more costly to the government.

Currently, there is only one fixed-price production contract in the active GOCO AAPs. However, the maintenance and special project tasks the contractor is required to perform are done on a cost-type contract.

G. GAO AND HQ AMC EXAMINATIONS.

GAO concluded that AMCCOM's use of cost-type contracts were appropriate under the existing circumstances. There was a clear link between their findings and conclusions.

AMC recommended to transition GOCO contracts to FFP by FY89. The APRO research team did not find trackability from AMC's data which supported the FFP recommendation. It was the researchers' perception that the AMC personnel involved in compiling the results of their examination believed that many of the pricing, estimating and management control problems (they perceived) would cease to exist under an FFP contract. However, it was not clear that the AMC personnel gave full consideration to all the conditions necessary to effectively utilize FFP contracts.

Nonetheless, the GAO report and the AMC examination, while disagreeing on the advisability of using FFP contracts in GOCOs, did agree that a prerequisite for the use of FFP contracts is a stabilized production schedule.

H. SUMMARY.

According to the data collected, the current contracting environment is unstable. According to some of the data, one might surmise that there may be varying degrees of instability at the different plants. Those differences might be explained by the differing missions of the plants; however, the data collected cannot provide those answers. It can only attest to the instability that is shown to exist.

Data from the other studies reviewed were consistent with that data collected by APRO. It all attests to the existence of instability. The semi-annual schedule initiative, introduced as an attempt to decrease the

instability the contractor experiences during production, may be successful for its intended purpose. It does not, however, overcome many of the obstacles to fixed-price contracting that currently exist.

CHAPTER VI

FINDINGS AND CONCLUSIONS

A. INTRODUCTION.

The objective of this project was to comment upon the advisability of using cost-type or fixed-price contracts for ammunition production at the GOCO AAPs. The path to this objective began with an examination of the GOCO contracting environment. The examination centered on the degree of the stability (and certainty) experienced by the ammunition requirements in the GOCO AAP contracting environment. A relatively high degree of stability and certainty would, according to both the regulatory requirements (see chapter IV) and published guidance, provide an environment that would demand the use of a fixed-price contract. Conversely, use of a fixed-price contract in an environment with a high degree of instability and uncertainty would fail to be appropriate.

B. CONCLUSIONS.

1. General

Many advantages can accrue with the use of FFP contracts if they are properly employed. It is tempting to try to capture the benefits FFP contracts offer. They are the easiest and least costly type of contract to administer, they encourage contractor efficiency and economy with the maximum risk for profit or loss being borne by the contractor, and they allow the accurate obligation of funds at the outset.[3] However, the inappropriate use of FFP contracts can result in a number of problems, most of which relate to higher costs, delayed deliveries, and inferior products.

One of the major criteria for the proper use of FFP contracts is that of requirement stability. Currently, the GOCO production contracts do not

meet that criterion. The instability factor and the other major obstacles and complications attendant to the improper use of fixed-price contracts in GOCO AAP plants are discussed below.

2. Obstacles to Fixed-Price Contracting

a. Instability

There are many obstacles that lie in the path of the effective utilization of fixed-price contracts for GOCO AAPs. First and foremost is the relatively high degree of instability and uncertainty associated with the production of ammunition. Every source of information substantiated the existence of this instability. That information, in and of itself, presents a great impediment to the use of fixed-price contracts since the FAR guidance for their use requires that fair and reasonable prices be established at the outset. Without having relatively fixed requirements for items, quantities and schedules, no basis exists upon which to determine fair and reasonable prices.

b. GFM

While a firm-fixed-price contract is believed to best utilize the basic profit motive of a business enterprise, they should only be used when the degree of risk is minimal or can be predicted with a reasonable degree of accuracy. Based upon the interviews conducted and the data collected, the risk of requirement instability during the course of a GOCO AAP contract is currently neither minimal nor predictable with a reasonable degree of accuracy. This is due not only to the inherent instability of the requirements determination process, but also to the uncertainty associated with the large amount of GFM shipped into the plants. The study (see previous chapter) that examined reasons for schedule instability at McAlester AAP, while only a single data point, found that more than 46% of the schedule

changes were due to shortages of raw materials, including GFM and GFE. Accurate records that document the reasons for every schedule change are not available. However, the results of the McAlester study combined with the perceptions of the AMCCOM GOCO Contract Specialists, Contracting Officers and Division Chief, lead to a conclusion that late and defective GFM may significantly contribute to the production instability experienced by the GOCO AAPs.

c. Maintenance and Special Projects

Not only are some of the maintenance and special projects unpredictable, but the nature of many of them do not lend themselves to fixed price contracts since a scope of work that is firm enough for the use of such a contract cannot be developed at the outset.

3. Complications With Fixed-Price Contracts

The apparent benefits to be derived from fixed-price contracts will be lost if the contract-type is inappropriately used. Moreover, inappropriate use of fixed-price contracts in the GOCO AAPs can lead to a number of problems, some of which are identified below.

If, for the moment, the regulatory guidance were to be ignored, and the use of a fixed-price contract were assumed in the current environment, it would be reasonable to expect the following scenario to be true. While the scenario is not indicative of a specific plant, it is thought to be an accurate composite assembled from the data collected during the course of this study.

The contractor would receive a higher fee (profit) than he currently receives since fixed-price contracts tend to carry higher rates of fee (profit) than cost contracts because, theoretically, a greater risk to the contractor is involved. It is unlikely (at least during the first few years

of a fixed-price contract) that the overall cost would be less since the contractor could not immediately change the way it is doing business. Some transition time would be involved in order for the government to reap the benefits of a fixed-price contract, if there are to be any.

Since it would be expected that the operation and maintenance portion of the GOCO AAP operating contractor's responsibility would remain reimbursable on a cost-type basis, concern about costs migrating from the fixed-price production contract to the cost contract would be valid. Close attention would have to be paid to those areas, particularly the maintenance-related ones, where the same personnel may be charged to either production or non-production maintenance tasks. While the opportunity for cost migration always exists where different types of contracts are used in the same facility, adequate government surveillance could minimize any impact.

The COR staffs would have an extensive problem adjusting to fixed-price contracts. Personnel would have to receive additional training and experienced, outside help, from perhaps AMCCOM, would be required temporarily. Evaluations and negotiations of fixed-price contracts are much more critical, in terms of details taking on a greater importance, than are the cost-type contracts. The mix of personnel (auditors, pricing, technical, contract administration) and the number of personnel would have to be adjusted to effectively deal with fixed-price contracts.

The instability that presently exists in the ammunition requirements determination process would have to end. Otherwise, all but the most minor changes would require extensive administrative effort. Added work, whether in quantity or items, would require a formal solicitation, proposal, evaluation, negotiation and award procedure. Canceled work, again whether in items or quantities, would require formal termination procedures. All this would be

happening against a background where the production lead times average four - nine months; therefore, it would be more the rule than the exception for added work to be at least partially complete (perhaps even totally complete) prior to an agreement on prices.

One can see from the complications that can arise, that shifting to fixed-price contracts without a thorough analysis, proper prior planning, and well-thought out coordinated action is doomed to failure. However, the above complications will not materialize if regulatory guidance and good business judgement are followed.

4. Applicability of Fixed-Price Contracts

Based upon the results of this study it is concluded that fixed-price contracts are not appropriate for use in the current GOCO contracting environment. Should the environment change, their applicability would have to be re-examined. Perhaps there are ways to change the contracting environment so it would be more favorable to fixed-price contracts, but such an analysis would prove to be a major multi-disciplinary (multi-functional) undertaking with no guarantee of success.

Under the current conditions surrounding the ammunition requirements determination process, the small degree of control that AMCCOM can exercise is insufficient to see that the requirements are structured in a manner that can meet the criteria for the use of fixed-price contracts.

As mentioned earlier in the report, one of the AAPs is currently using a fixed-price contract for production. While this research did not focus on that specific contract (at Scranton AAP), if the contracting environment at Scranton AAP is similar to the general environment this research found to exist, the government is not deriving the benefits that such a contract-type should be providing. However, since a detailed examination of

Scranton AAP was not included in the scope of this effort, this study can only raise the above concern as an issue to be examined rather than a finding to be acted upon. It is recommended that future contracts at Scranton AAP undergo a thorough evaluation to assure that continuing to use an FFP contract for production is in the best interest of the government. The trip report done as a part of the HQ, AMC examination voiced similar concerns suggesting that a possible way to obtain fairer prices was to move away from fixed-price contracts.[8]

C. RECOMMENDATION.

At this time it does not appear that any of the AAPs with cost-type contracts should be considered for immediate transition to fixed-price contracts. It is the recommendation of this report to retain cost-type contracts at AAPs. Without a radical change in the process for determining ammunition requirements, the only AAPs that could be considered for fixed-price contracts in the future would be those plants with single or very limited product lines, since the likelihood of introducing stability into those plants is much greater than it would be in the plants that produce many different products. However, even if greater production stability could be introduced into a plant, proper utilization of a fixed-price contract would demand relatively firm requirements for at least an 18-month period, not just for six months. This would allow stability from the time of the government's solicitation through proposal submission, evaluation, negotiation, contract award and performance. But prior to the use of any fixed-price contract, a great deal of planning and coordination would be necessary or the results would likely be detrimental to the government, either in economic cost, the cost of readiness, or both.

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APPENDIX A

EXTRACTS FROM HQ, AMC TRIP REPORTS FOR ACTIVE GOCO AAP's

A. SUNFLOWER AAP - "A FFP contract is recommended when production is more stable."

B. HOLSTON AAP - "CPIF inappropriate - CPFF preferred."

C. SCRANTON AAP - "Continuous use of firm fixed-price contracts in light of valid DCAA audit objections, sole source procurements, unknown and fluctuating workload requirements and workload requirement which do not utilize production capabilities is not in the best interest of the Army."

"Possible ways to obtain fairer prices are: ...move away from fixed price contracts..."

D. INDIANA AAP - "Consideration should be given to transition to firm-fixed price contracting as there is nothing inherent in bag manufacturing and load, assembly and pack operations that precludes FFP contracts - provided that requirements are timely identified and funded."

E. MILAN AAP - "The CPIF type contract provides very little incentive for cost reduction, but the use of a firm fixed price contract in my opinion would not be any improvement at Milan." This conclusion is based upon the following:

1. Some of the items are under development, a firm fixed price cannot be established.

2. Many of the items produced at Milan contain Government furnished parts which are many times late.

3. In the GOCO environment the changes and uncertainties involved in contract performance would only benefit the contractor.

4. It is very questionable that a firm fixed price contract would motivate the contractor to take risk and reduce cost.

F. LOUISIANA AAP - "CPIF contracts are inappropriate. We recommend a CPAF arrangement. The COR staff prefers a CPFF."

"To date [since 1982], the use of CPIF has been counter-productive."

G. No recommendations as to contract type were made in the trip reports for the following GOCO AAPs:

LONGHORN AAP
LONE STAR AAP
HAWTHORNE AAP
IOWA AAP
KANSAS AAP
LAKE CITY AAP
MISSISSIPPI AAP

APPENDIX B

PRELIMINARY FINDINGS FROM AAP INTERVIEWS

A. Based upon interviews and data collection at Lone Star AAP and Radford AAP during September 1986, a set of preliminary findings were developed. The interviews were conducted with the government COR staff and contractor management and staff personnel to achieve a more balanced perspective.

B. Then, during October 1986 the findings were communicated to the primary contract specialists responsible for the contract(s) with each of the 13 active GOCO AAPs. Through this method, the researchers attempted to determine the applicability and validity of these findings at each of the active plants. Not every finding was applicable to every plant, therefore, the contract specialists could not respond to all findings. Additionally, these findings were discussed with the GOCO Division Chief in AMCCOM's Procurement Directorate. He expressed general overall agreement with the findings.

1. All persons agreed with the following finding:

The operation, maintenance and special project tasks performed by the contractor would present problems if fixed-price. Unless the scopes could be totally comprehensive, deferring maintenance or cutting corners on projects would increase contractor profits. Both government and contractor personnel indicated this would be a risk.

2. With the exception of the contract specialist for Mississippi AAP and Scranton AAP (the Iowa AAP contract specialist deemed this finding not applicable), all respondents agreed with the following finding:

The ammunition requirements furnished to AMCCOM for acquisition are unstable up until the time a contract is actually awarded and they continue to be so during the contract period.

3. With the exception of the contract specialist for Mississippi AAP (the Iowa AAP contract specialist deemed this finding not applicable), all respondents agreed with the following finding:

Because of the instability, the contractor's proposal is based upon one set of requirements, the actual negotiation is based upon a changed set of requirements, and the "final" requirements at the time of contract award are different yet. Additionally, the "final" requirements continue to change.

4. With the exception of the contract specialist for Mississippi AAP (the Iowa AAP contract specialist deemed this finding not applicable), and with minor reservation from two AAPs, all respondents agreed with the following finding:

According to recent historical data, the changes in quantities, schedules and items continue through the life of the contract, sometimes happening as often as monthly.

5. With the exception of the contract specialists for Hawthorne AAP and Scranton AAP (which is currently fixed-price), with some minor qualifications, all respondents (the Iowa AAP contract specialist deemed this not applicable) agreed to the following finding:

Currently, the COR staffs at the AAPs do not have the necessary expertise and/or proper mix of personnel to effectively handle fixed-price contracts.

6. Of the 12 contractors with cost-type contracts, eight had discussed contract type with the contract specialists. Of those eight, five expressed a willingness to enter into fixed price contracts while three were not interested. Because of this, the following preliminary finding cannot be said to be either true or false:

According to contractor personnel, there is general agreement to enter into fixed-price contracts provided the quantities, schedules and items can remain reasonably firm for the contract period.

7. While 6 of the 13 contract specialists found the following finding to be inapplicable for one reason or another, the seven respondents all agreed with the finding that:

Due to the time involved from contractor proposal preparation until the finalization of negotiations, if GOCO AAP contracts were fixed-price and changes were required, the negotiated changes may often be finalized using a high percentage of "actual" costs versus estimated costs.

8. All persons agreed with the following finding:

A firm-fixed price contract will serve to double or triple the percentage (in relation to estimated contract costs) the contractor receives in the negotiated profit rate.

9. All persons agreed with the following finding:

The pricing method of a contract should theoretically represent and allocate among the parties the risks inherent in performance. Simply converting to a fixed-price contract within the current environment would not lower the total cost associated with the risk of changes.

STUDY TEAM COMPOSITION

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